

What is claimed is:

1. A welding machine for inserting a first cylinder member into a second cylinder member and for welding the cylinder members together around their circumference, the welding machine comprising:

an energy source for generating energy, the energy being used for melting the cylinder members at a portion to be welded and for welding the cylinder members together; and

energy-applying units for applying the energy to the cylinder members, wherein:

the energy-applying units are disposed outside the cylinder members at two positions; and

when an angle, by which the energy-applying units are separated from each other around the circumference of the cylinder members, is defined by  $\theta$  degrees,  $80 \leq \theta \leq 100$ .

2. A welding machine for inserting a first cylinder member into a second cylinder member and for welding the cylinder members together around their circumference, the welding machine comprising:

an energy source for generating energy, the energy being used for melting the cylinder members at a portion to be welded and for welding the cylinder members together; and

energy-applying units for applying the energy to the cylinder members, wherein:

the energy-applying units are disposed outside the cylinder members at three or more positions; and

when a number of the energy-applying units is defined by "n" and an angle, by which the neighboring energy-applying units are separated from each other in a circular direction about the cylinder members, defined by  $\theta$  degrees,  $[(360/n) - 10] \leq \theta \leq [(360/n) + 10]$ .

3. The welding machine according to claim 1, wherein:

the energy-applying units are disposed on a plane perpendicular to a center axis of the cylinder members; and

the energy is introduced from the energy-applying units to the cylinder members along the plane.

4. An injector to be assembled by welding, the injector comprising:

a valve body including a valve seat;

a valve member for stopping fuel injection when seated on the valve seat, and for permitting fuel injection when separated from the valve seat;

a movable core connected to the valve member at an opposite side of the valve seat, the movable core reciprocating together with the valve member;

a fixed core disposed opposite the valve member relative to the movable core, the fixed core facing the movable core;

an electromagnetic driving device for generating magnetic force by which the movable core is attracted to the fixed core; and

a housing member of which an inner peripheral wall is

connected to an outer peripheral wall of the valve body, the housing member containing the movable core so as to reciprocate therein, wherein:

each of the housing member and the valve body is a cylinder member; and

the valve body is inserted into the housing member, and they are welded to each other by melting them about a circumference of the housing member.

5. The injector according to claim 4, wherein:

each of the valve member and the movable core is a cylinder member; and

the valve member is inserted into the movable core, and they are welded to each other by melting them about the circumference of the movable core.

6. The injector according to claim 5, wherein:

the injector includes a magnetic member, disposed outside the housing member and the fixed core, for magnetically connecting the housing member and the fixed core;

the magnetic member is a cylinder member; and

the housing member is inserted into the magnetic member, and the housing member and the magnetic member are welded to each other by melting them about the circumference of the magnetic member.

7. The welding machine according to claim 1, for an

injector, the injector comprising:

a valve body including a valve seat;

a valve member for stopping fuel injection when seated on the valve seat, and for permitting fuel injection when separated from the valve seat;

a movable core connected to the valve member at an opposite side of the valve seat, the movable core reciprocating together with the valve member;

a fixed core disposed opposite the valve member relative to the movable core, the fixed core facing the movable core;

an electromagnetic driving device for generating magnetic force by which the movable core is attracted to the fixed core; and

a housing member of which inner peripheral wall is connected to an outer peripheral wall of the valve body, the housing member containing the movable core so as to reciprocate therein, wherein:

each of the housing member and the valve body is a cylinder member; and

the valve body is inserted into the housing member, and the valve body and the housing member are welded to each other by melting them about a circumference of the housing member.

8. The welding machine according to claim 7, wherein:

each of the valve member and the movable core is a cylinder member; and

the valve member is inserted into the movable core, and

the valve member and the movable core are welded to each other by melting them about the circumference of the movable core.

9. The welding machine according to claim 8, wherein:

the injector includes a magnetic member, disposed outside the housing member and the fixed core, for magnetically connecting the housing member and the fixed core;

the magnetic member is a cylinder member; and

the housing member is inserted into the magnetic member, and the housing member and the magnetic member are welded to each other by melting them about the circumference of the magnetic member.

10. The welding machine according to claim 7, wherein:

the injector includes a magnetic member, disposed outside the housing member and the fixed core, for magnetically connecting the housing member and the fixed core;

the magnetic member is a cylinder member; and

the housing member is inserted into the magnetic member, and the housing member and the magnetic member are welded to each other by melting them about the circumference of the magnetic member.

11. The welding machine according to claim 4, wherein:

the injector includes a magnetic member, disposed outside the housing member and the fixed core, for magnetically connecting the housing member and the fixed core;

the magnetic member is a cylinder member; and

the housing member is inserted into the magnetic member, and the housing member and the magnetic member are welded to each other by melting them about the circumference of the magnetic member.

12. The welding machine according to claim 2, wherein:

the energy-applying units are disposed on a plane perpendicular to a center axis of the cylinder members; and

the energy is introduced from the energy-applying units to the cylinder members along the plane.

13. The welding machine according to claim 12, for an injector, the injector comprising:

a valve body including a valve seat;

a valve member for stopping fuel injection when seated on the valve seat, and for permitting fuel injection when separated from the valve seat;

a movable core connected to the valve member at an opposite side of the valve seat, the movable core reciprocating together with the valve member;

a fixed core disposed opposite the valve member relative to the movable core, the fixed core facing the movable core;

an electromagnetic driving device for generating magnetic force by which the movable core is attracted to the fixed core; and

a housing member of which inner peripheral wall is

connected to an outer peripheral wall of the valve body, the housing member containing the movable core so as to reciprocate therein, wherein:

each of the housing member and the valve body is a cylinder member; and

the valve body is inserted into the housing member, and the valve body and the housing member are welded to each other by melting them about a circumference of the housing member.

14. The welding machine according to claim 2, for an injector, the injector comprising:

a valve body including a valve seat;

a valve member for stopping fuel injection when seated on the valve seat, and for permitting fuel injection when separated from the valve seat;

a movable core connected to the valve member at an opposite side of the valve seat, the movable core reciprocating together with the valve member;

a fixed core disposed opposite the valve member relative to the movable core, the fixed core facing the movable core;

an electromagnetic driving device for generating magnetic force by which the movable core is attracted to the fixed core; and

a housing member of which inner peripheral wall is connected to an outer peripheral wall of the valve body, the housing member containing the movable core so as to reciprocate therein, wherein:

each of the housing member and the valve body is a cylinder member; and

the valve body is inserted into the housing member, and they are welded to each other by melting them about a circumference of the housing member.

15. The welding machine according to claim 13, wherein:

each of the valve member and the movable core is a cylinder member; and

the valve member is inserted into the movable core, and the valve member and the movable core are welded to each other by melting them about the circumference of the movable core.

16. The welding machine according to claim 15, wherein:

the injector includes a magnetic member, disposed outside the housing member and the fixed core, for magnetically connecting the housing member and the fixed core;

the magnetic member is a cylinder member; and

the housing member is inserted into the magnetic member, and the housing member and the magnetic member are welded to each other by melting them about the circumference of the magnetic member.

17. The welding machine according to claim 14, wherein:

each of the valve member and the movable core is a cylinder member; and

the valve member is inserted into the movable core, and



the valve member and the movable core are welded to each other by melting them about the circumference of the movable core.

18. The welding machine according to claim 13, wherein:

the injector includes a magnetic member, disposed outside the housing member and the fixed core, for magnetically connecting the housing member and the fixed core;

the magnetic member is a cylinder member; and

the housing member is inserted into the magnetic member, and the housing member and the magnetic member are welded to each other by melting them about the circumference of the magnetic member.

19. The welding machine according to claim 17, wherein:

the injector includes a magnetic member, disposed outside the housing member and the fixed core, for magnetically connecting the housing member and the fixed core;

the magnetic member is a cylinder member; and

the housing member is inserted into the magnetic member, and the housing member and the magnetic member are welded to each other by melting them about the circumference of the magnetic member.

20. The welding machine according to claim 14, wherein:

the injector includes a magnetic member, disposed outside the housing member and the fixed core, for magnetically connecting the housing member and the fixed core;

the magnetic member is a cylinder member; and

the housing member is inserted into the magnetic member, and the housing member and the magnetic member are welded to each other by melting them about the circumference of the magnetic member.

21. A welding method for welding cylinder members together using a welding machine, the welding method comprising the steps of:

rotating a first cylinder member and a second cylinder member about a center axis located inside of the first and second cylinder members;

providing a first energy applying unit disposed outside of the first cylindrical member and the second cylindrical member;

providing a second energy applying unit disposed outside of the first cylindrical member and the second cylindrical member;

providing an energy source for generating energy for the energy applying units;

applying energy to the first cylindrical member and the second cylindrical member through the first energy applying unit;

melting the first cylindrical member and the second cylindrical member a first time with the first energy applying unit as the cylindrical members are rotated; and

welding the first cylindrical member and the second

cylindrical member a first time with the first energy applying unit as the cylindrical members are rotated;

melting the first cylindrical member and the second cylindrical member a second time with the second energy applying unit as the cylindrical members are rotated; and

welding the first cylindrical member and the second cylindrical member a second time with the second energy applying unit as the cylindrical members are rotated;

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